Potential CSCOR Projects: Major Issues in Lake Erie Research

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NOAA Worskhop

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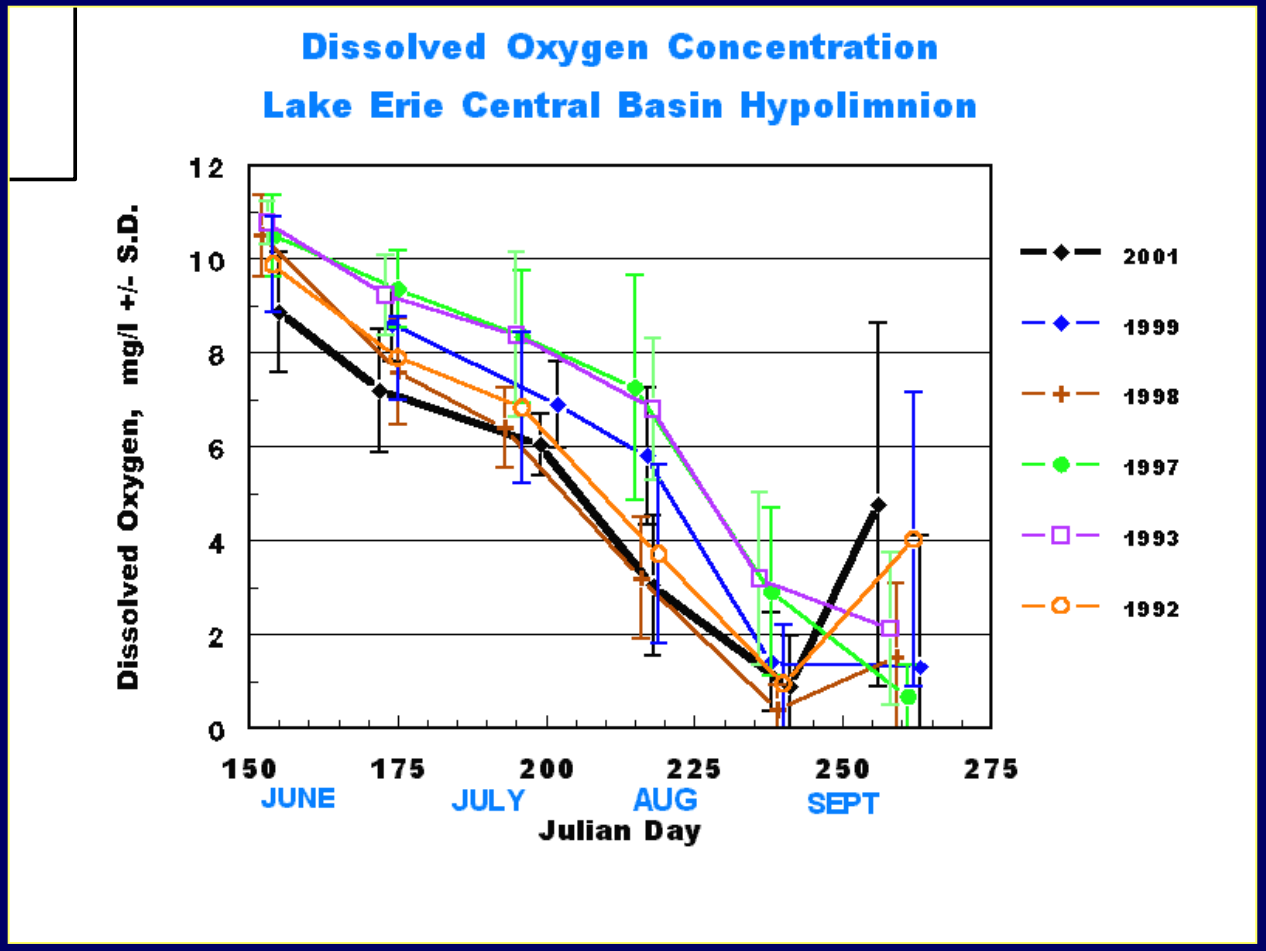
University of Michigan

Recent changes in Lake Erie

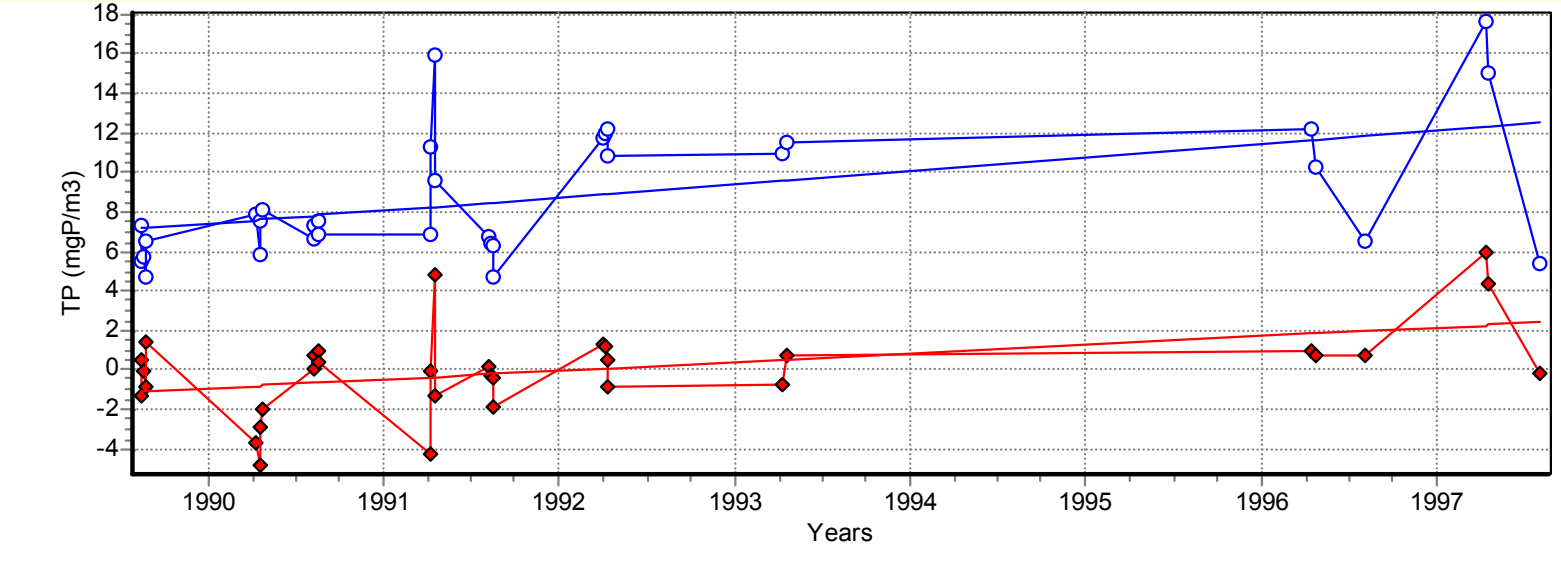
1) Increased hypolimnion hypoxia



Rockwell 2002

Recent changes in Lake Erie

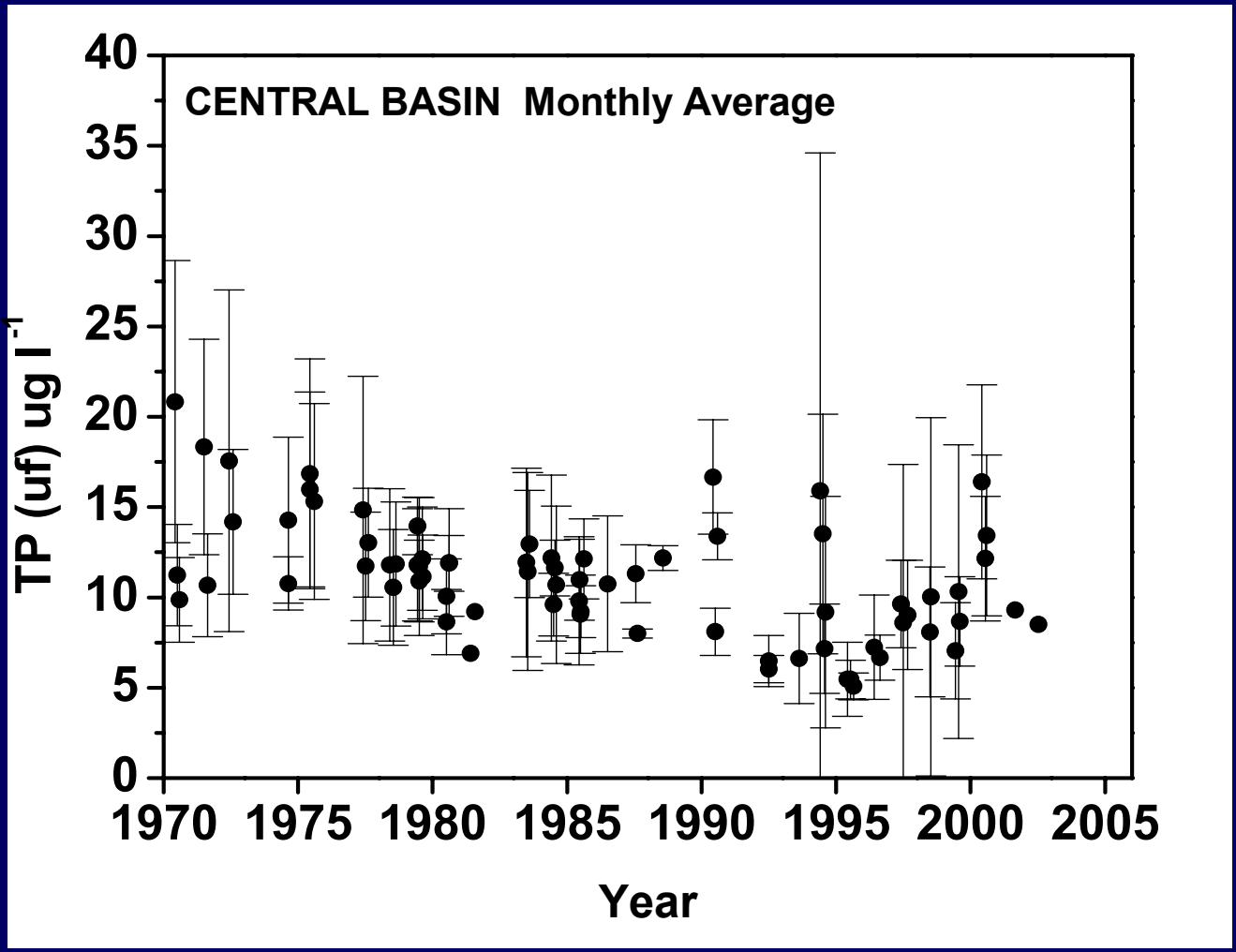
2) Increased P concentrations



Burns 2003

Recent changes in Lake Erie

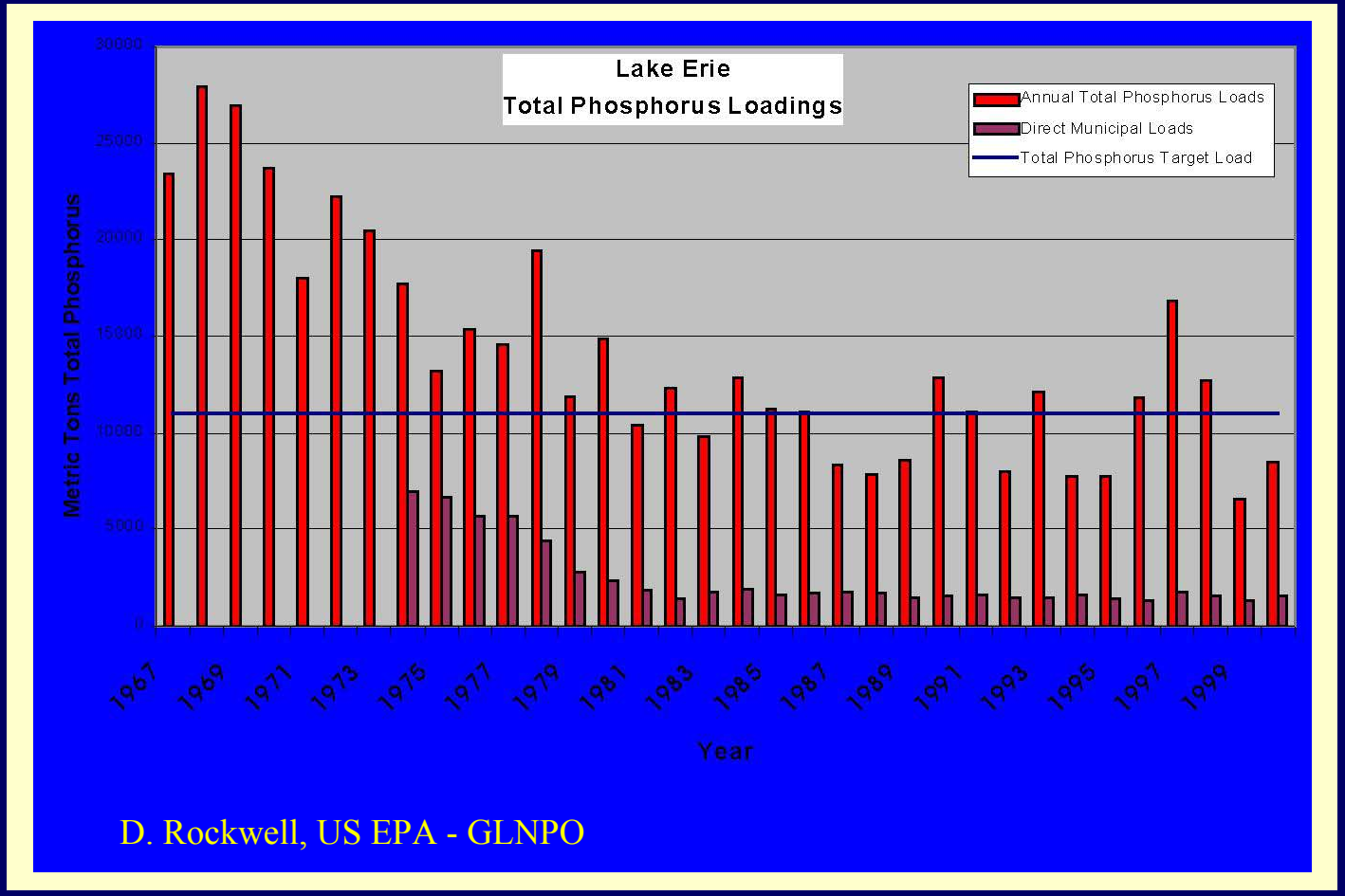
2) Decreased, Increased P concentrations



M. Charlton - Environment Canada

Recent changes in Lake Erie

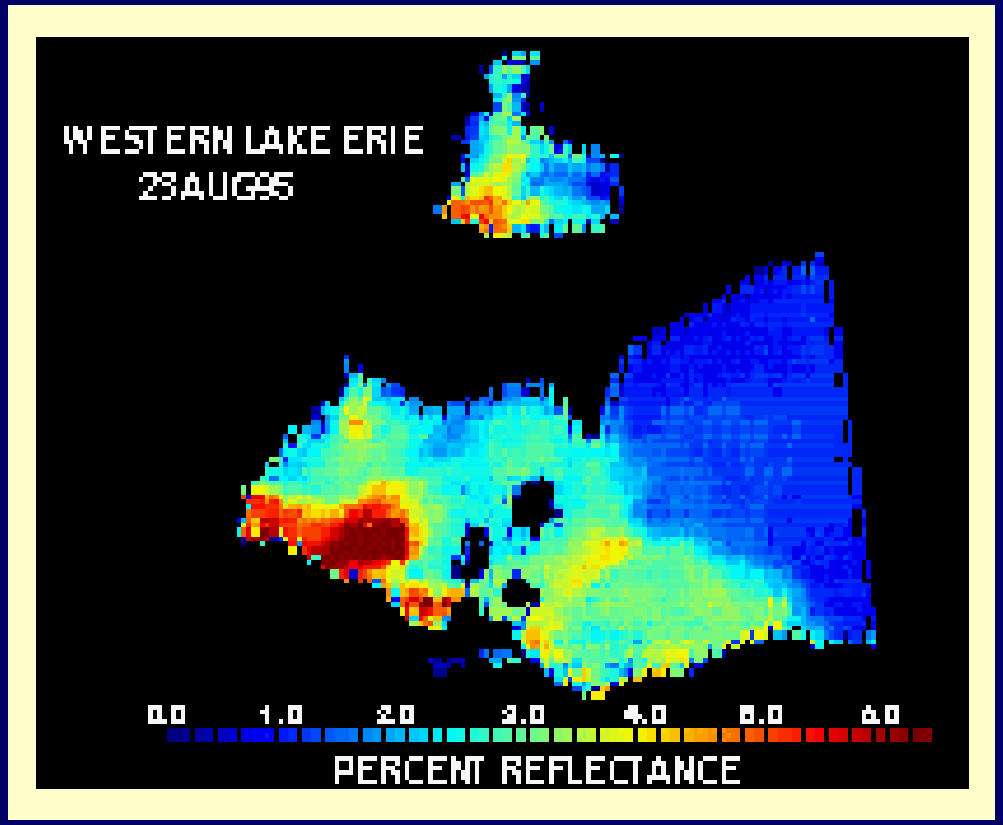
3) Decreased P loadings



Recent changes in Lake Erie

4) Plankton community biomass, structure

* Microcystis (Western Basin)
* Cladophora



GLERL 2002

Recent changes in Lake Erie

5) Invasives

* Dressenids
* Gammarus
* Other invertebrates
* Ruffe, Goby

Recent changes in Lake Erie

5) Invasives Con't

Nonindigenous animals established in the Great Lakes drainage since the mid-1980s

Common name	Year of Discovery	Endemic region
Ruffe	1986	Ponto- Caspian
Zebra mussel	1988	Ponto- Caspian
Quagga mussel	1989	Ponto- Caspian
Rudd	1989	Eurasia
Round goby	1990	Ponto- Caspian
Tubenose goby	1990	Ponto- Caspian
New Zealandmudsnail	1991	New Zealand
Blueback herring	1995	Atlantic, N. A.
Echinogammarus amphipod	1994	Ponto- Caspian
Acineta noticrae ciliate	1997	Eurasia
Cercopagis waterflea	1998	Ponto- Caspian
Daphnia lumholtzi	1999	Africa, Asia, Aust.
Schizopera borutzkyi	1999	Ponto- Caspian
Heteropsyllus nr. Nunni	1999	Atlantic, N.A.

Modified from Ricciardi & MacIsaac, Trends in Ecology and Evolution (2000)

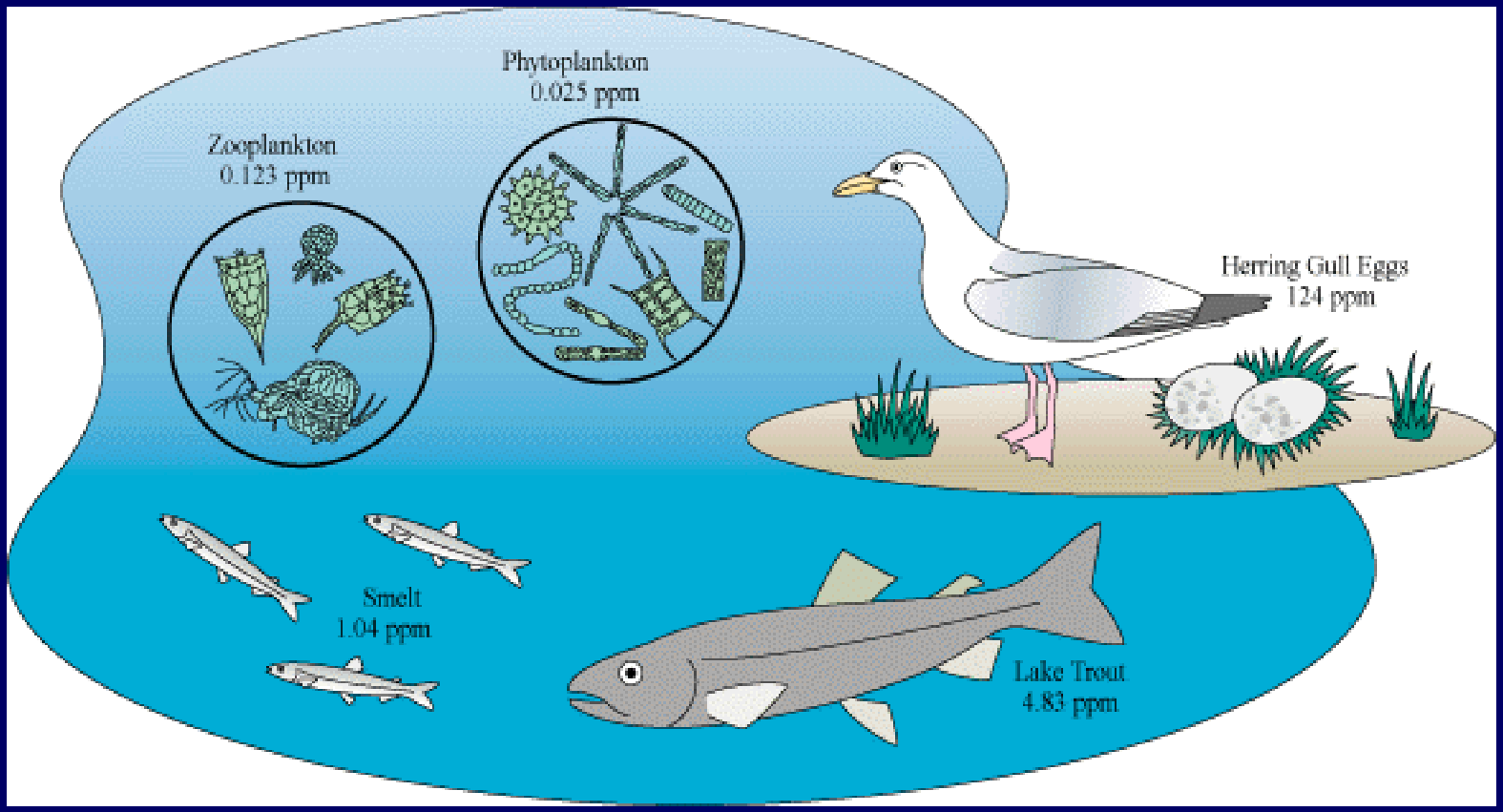
Recent changes in Lake Erie

6) Avian botulism (Eastern Basin)

G. Bortolotti

Recent changes in Lake Erie

7) Contaminant bioaccumulation



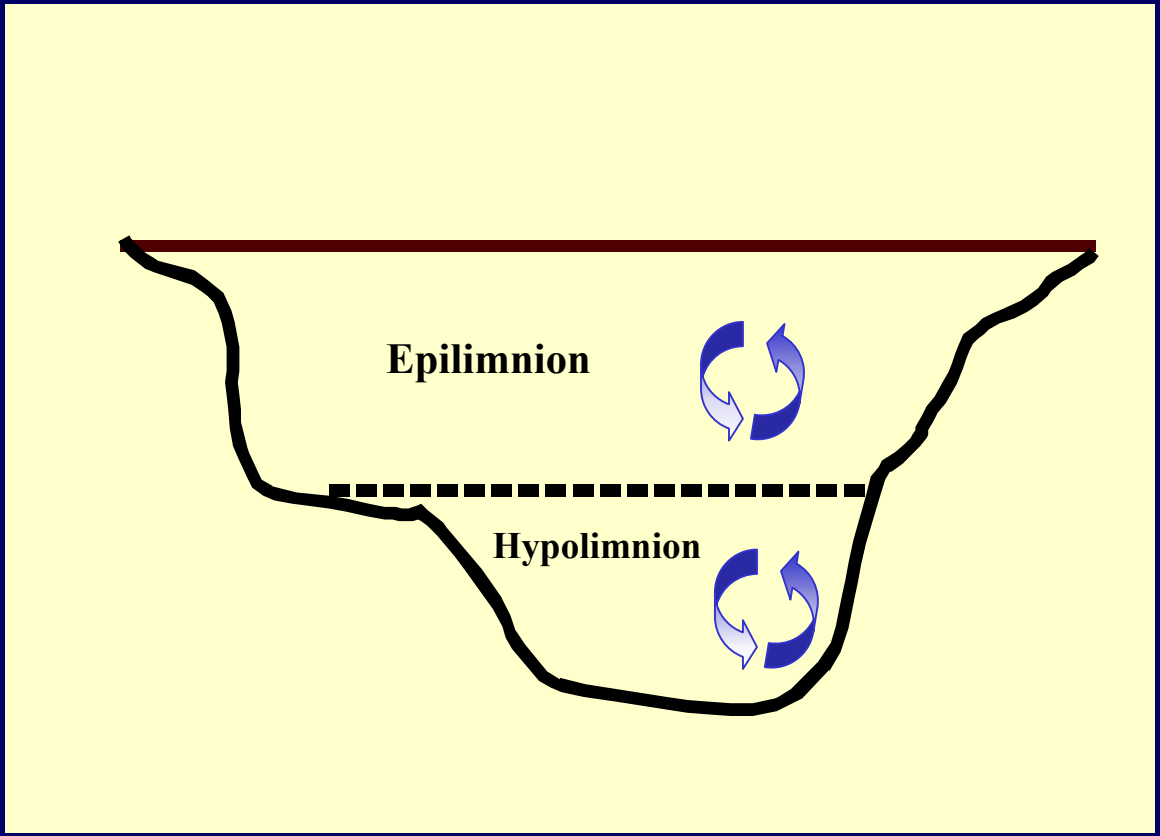
Environment Canada

Recent changes in Lake Erie

8) Dynamic fish community structure

Explanations for Recent Changes

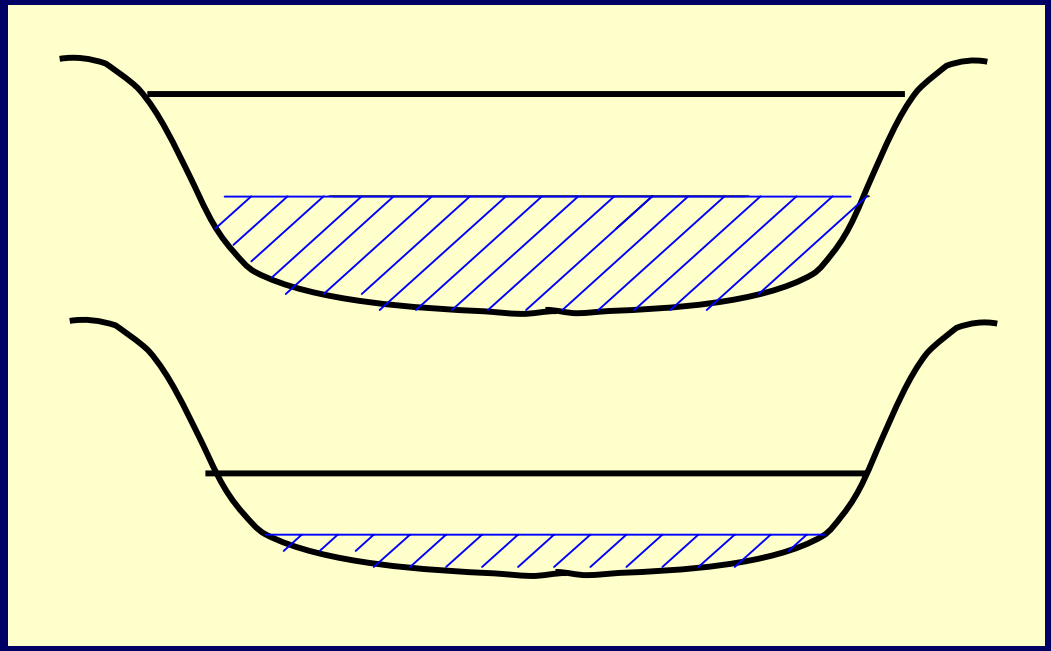
1) Natural variation of a highly dynamic system



Explanations for Recent Changes

2) Reduced size, increased persistence of central basin hypolimnion

* longer stratification period
* lower lake levels
* warmer
* strong storms



Explanations for Recent Changes

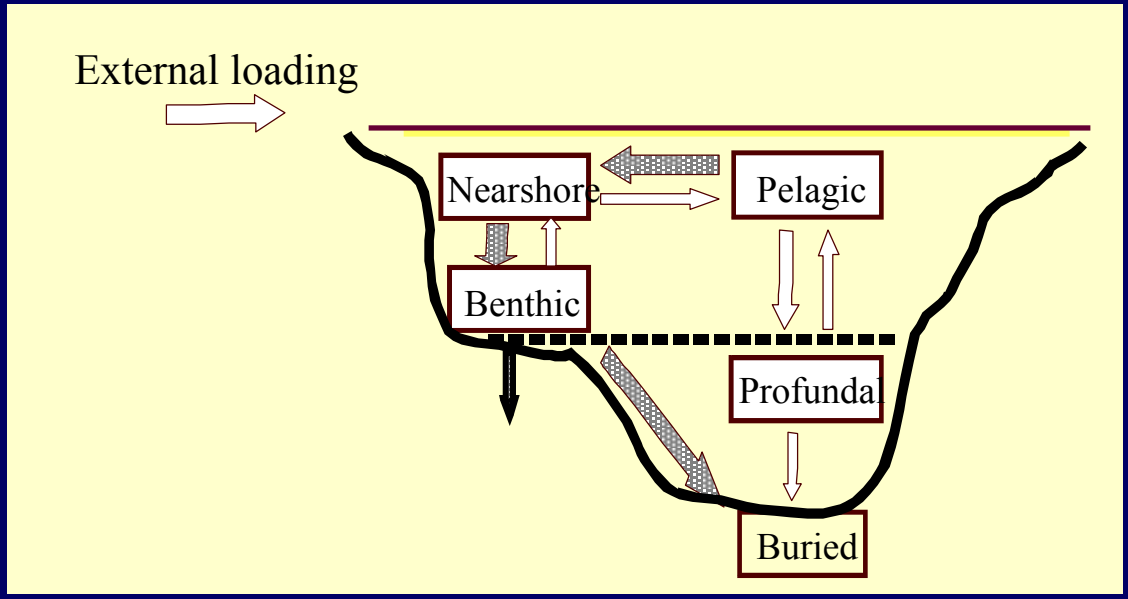
3) Reduced primary production

* grazing
* nutrient, trace metal limitation
* UV penetration

Explanations for Recent Changes

4) Increased organic carbon accumulation

* increased P loading
* increased rates, new pathways of internal cycling
* nearshore shunt model (**R. Smith *et al.* Univ. of Waterloo**)

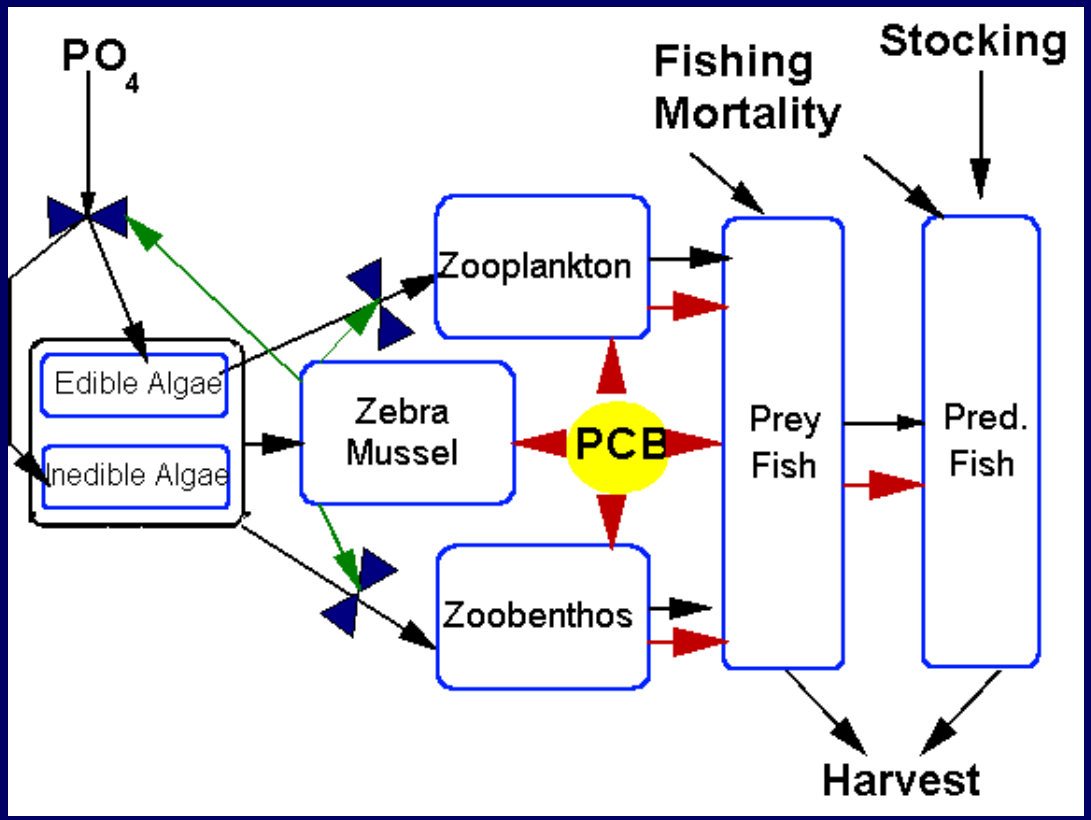


Explanations for Recent Changes

5) Invasives modification of ecosystem

Other Approaches

1) Need for Revised Nutrient Cycling, Ecosystem Models



Locci and Koonce 1999

Lake Erie Millennium Plan: Research Needs

1) Disruption at base of the food web
2) Contaminant dynamics and bioaccumulation
3) Habitat degradation
4) Disruption at the top of the food web (fish stocking,birds)
5) Invasives
6) Climate change
7) Human health effects

Conclusions

- Significant recent degradation in water quality
- ‘New’ water quality degradation problems, unequally distributed
- Recent changes to trophic system and transfer
- Invasives
- Contaminant bioaccumulation, human health
- Dynamic fish community structure
- Unknown importance of natural physical variations
- Revised nutrient cycling, ecosystem models needed